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EXAMINER	
HALL, ASHA J	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/722,738	Applicant(s) ORTABASI, UGUR	
	Examiner ASHA HALL	Art Unit 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 April 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

2. Claim 17 recites the limitation "said Cassegranian" in claim 15. There is insufficient antecedent basis for this limitation in the claim. It appears that claim 17 should depend on claim 16.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claim 1-4 and 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman (6,372,979 B1) in view of Wanlass (5,376,185).

With regard to claim 1, Streetman discloses a photovoltaic module/plurality of photovoltaic cells (col.3; lines 17-20) for converting a coherent laser radiation/artificially generated radiant energy (col.3; lines 21-23) from a laser emitting light at a wavelength into electrical power, said module comprising:

(a) A housing having a cavity of generally optimized closed shape/spherical inner surface inside said housing (col. 3; lines 25-27), said cavity having an internal surface area A_s and including opening for admitting said laser radiation into said cavity, said

opening having an entrance aperture area A_i that is substantially smaller than A_s (As shown in Figure 1); (b) a plurality of photovoltaic cells (col.3; lines 17-20) within said cavity.

Streetman fails to disclose the said photovoltaic cells have an appropriate band gap energy to respond to said wavelength and generate said electrical power. However, Wanlass discloses a computer model for single junction photovoltaic (solar) cells that calculates an optimum band gap for a given radiating conditions (col.3; lines19-32). Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to use the appropriate band gap energy (modeled given by Wanlass) of Streetman photovoltaic module to respond to the said wavelength in order to generate electrical power.

With respect to claim 2, Streetman discloses the elements as discussed with regard to claim 1, wherein each said photovoltaic cell having a receiving surface on which said laser radiation is incident (col. 2; lines 4-6), but fails to describe the photovoltaic as a single junction cell. However, Wanlass discloses the use of a single junction for his concentrator solar cell (col. 1, lines 36-41). Also, he teaches that a concentrator solar cell operates at higher light generated current density, and the single junction cell is also less costly (col.2; lines 19-22). Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to use Wanlass single junction cell in the photovoltaic module of modified Streetman to respond to the said wavelength in order to generate electrical power in a less costly manner.

With respect to claim 3, Streetman discloses the elements as discussed with regard to claim 2, wherein each photovoltaic cell is provided with a back surface mirror/ reflective material (col.3; lines 50-54) for reflecting photons not absorbed by a photovoltaic cell on which said photons are incident.

In regard to claim 4, Streetman discloses the elements as discussed with regard to claim 2, but fails to disclose the said photovoltaic cells with a given quantum efficiency selected to optimize the conversion of said wavelength of said radiant energy. However, Wanlass describes a computerized calculation of solar cell efficiency determined as a function of the optimum band gap (col.3; lines 19-27). Hence, it would have been obvious to one of ordinary skill in the art at the time of invention to use Wanlass model to find the optimized quantum efficiency of modified Streetman at given wavelength.

In regard to claim 10, Streetman discloses all of the structured elements as discussed with respect to claim 1 above, but fails to specifically disclose the ratio of A_i to A_s as 0.1. However, similar specifications are shown in Streetman in Figure 1. It has been held that where the only difference between the prior art and the claims was recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device (see MPEP 2144.04 [R-1] IV.).

With respect to claim 11, Streetman discloses elements of claim 1, but fails to address the optimized wavelength of the photovoltaic cells. Whereas, Wanlass teaches

that his computer model can determine the solar cell efficiency as a function of the band gap of the cell (col. 3; lines 54-53). Also, Wanlass discloses a computer model for single junction photovoltaic (solar) cells that calculates an optimum band gap for a given radiating conditions (col.3; lines19-32). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply Wanlass models for choosing PV cells with an optimized band gap energy to be applied to the modified Streetman to operate at the optimum wavelength for maximized efficiency.

In regard to claim 12, Streetman discloses elements of the photovoltaic module of claim 1, but fails to address a peak of quantum efficiency response matching said wavelength. However, Wanlass discloses the method of calculating a peak of quantum efficiency response matching said wavelength (col.3; lines 57-60). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply Wanlass model to the modified Streetman to obtain peak efficiency.

5. Claim 5-7 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman (6,372,979 B1) and Wanlass (5,376,185) as applied to claim 1 above, in view of Lechner (5,365,920).

With respect to claim 5, modified Streetman discloses the elements as discussed with regard to claim 1, but fails to disclose a primary concentrator and a secondary concentrator secured to the opening. Lechner discloses a secondary concentrator system for receiving pre-focused said radiation from a primary concentrator (col.7; lines 44-51). Thus, it would have been obvious to one of ordinary skill in the art at the time of

invention to use Lechner primary and secondary concentrators outside of the modified Streetman for receiving and sending laser radiation into the module.

In regard to claim 6, Streetman discloses the elements as discussed with regard to claim 5, wherein he fails to disclose the said secondary concentrator with the inner surfaces that are mirrored. Lechner discloses the secondary concentrator with mirrored inner surfaces (col.1; lines 39-41) that focuses the incident radiation. The concentrators made of mirror glass provides equal or even better concentration of radiation impinging on the surface of both (primary and secondary) concentrators with a parallel structure (relationship) (col.2; lines 22-24). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to use Lechner secondary concentrator in conjunction with modified Streetman with mirrored inner surfaces for focusing radiation into the PV module.

With respect to claim 7, Streetman discloses the elements as discussed with regard to claim 6, but fails to show a secondary concentrator is a non-imaging, compound parabolic of hollow design. Nevertheless, Lechner describes that the secondary concentrator is a compound parabolic of hollow design (col.2; lines 7-10 and lines 33-36) and that it should provide for equal or even a better concentration of radiation hitting the surface of the concentrator. Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to use Lechner secondary concentrator of parabolic hollow design outside of modified Streetman for enhancing the focusing of radiation into the module.

In regard to claim 9, Streetman discloses disclose the said secondary concentrator including an integral extractor rod for guiding said light towards the center of said cavity and then to emit photons uniformly in all directions to provide angular isotropy of said photons (as shown in Figure 4).

6. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman (6,372,979 B1), Wanlass (5,376,185), and Lechner (5,365,920) as applied to claim 5 above, in view of Kuppenheimer et al. (4,710,630).

With respect to claim 8, Streetman discloses the elements as discussed with regard to claims 5 and 6, but fails to discuss the secondary concentrator as a Bezier optimized contour to provide a combination of maximum acceptance angle maximum concentration, and minimum height.

Kuppenheimer has disclosed the secondary concentrator as a compound parabolic concentrator (a Bezier optimized contour) (col.2; lines 45-46). He describes the maximum acceptance angle as the point where the curvature of the angle converting cone goes from a compound parabolic concentrator to a straight wall cone as the point where the marginal off axis ray (the ray from the lens which comes from the edge of the field of view and passes through the edge of the lens) strikes the collector wall, and is reflected to the edge producing the maximum acceptable impingement angle (col.2; lines 45-53). Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to use Kuppenheimer et al. secondary concentrator of a parabolic design outside of modified Streetman for focusing the incident radiation into the module.

7. Claim 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman (6,372,979 B1) and Wanlass (5,376,185) as applied to claim 1 above, in view of Holloman et al.(US 4,976,789), Rakuljic et al. (US 5,684,611), and Stone et al. (US 5,932,029).

With respect to claim 13, Streetman describes his photovoltaic module as including a plurality of solar cells within said spherical cavity to receive radiation wherein the radiation is capable of being converted to electrical energy (col.3; lines 1-3). Streeman further discloses a coherent laser radiation/artificially generated radiant energy (col.3; lines 21-23) from a laser emitting light at a wavelength into electrical power, said module comprising:

However, Streetman fails to address the solar cells having different energy band gaps and one wavelength filter associate with each solar cell and a laser radiation contains a power component of a selected wavelength with a multiplexed communications component of different wavelength/optical fiber with a multiplexer.

Holloman et al. discloses a laser that exits from the end of an optical fiber onto a conical photovoltaic to intercept the beam of light (abstract) and further discloses a device with a laser for generating a laser light and the optical filament is provided for directing the beam onto the conical annulus lined with photovoltaic to intercept the reflected light and convert into electric current (abstract). It would have been obvious to one of ordinary skill in the art at the time of the invention to corporate a laser beam from an optical fiber as taught by Holloman et al. to the modified photovoltaic device of Streetman in order to convert the incoming light into electrical current. However,

modified Streetman in view of Holloman et al. fails to disclose a multiplexer component on the fiber optic and also that some of the cells in the cavity having bandgaps corresponding to the power component of the laser radiation and at least some of the said cells having a bandgap corresponding to the communications component of the laser radiation.

Rakuljic et al. discloses solar absorber(abstract) and further discloses a holograms that are wavelength multiplexed to form gratings lying along a common axis that provides substantial improvement to wavelength selective filters (abstract). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate a multiplexer as taught by Rakuljic et al. to the photovoltaic device of modified Streetman in order to form gratings that would supply improvement to the wavelength selective filters. However, modified Streetman in view of Rakuljic et al. fails to disclose also that some of the cells in the cavity having bandgaps corresponding to the power component of the laser radiation and at least some of the said cells having a bandgap corresponding to the communications component of the laser radiation.

Stone et al. discloses the method to tailor the spectrum of radiation to photovoltaic cells for high efficiency conversion (col.1; lines 11-13). Wherein, some of the said solar cells each having different energy band gaps has their spectral responses span at least a portion of the solar spectrum (col.5; lines 33-40). Also, Stone et al. shows at least one wavelength filter associated with each solar cell (Figure 3A and 3B), wherein, at least one wavelength filter selected from the group consisting of filters thereby providing selective transmission and reflection of incident solar radiation (col.5;

lines 44-47). Hence, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the filters shown in Stone et al. to the modified Streetman, to efficiently utilize different energy band gaps of the solar spectrum.

In regard to clam 14, Streetman discloses elements of the photovoltaic module of claim 1, but fail to disclose it as a multi-junction (tandem stack cell). Whereas, Stone et al. explicitly states that their photovoltaic (PV) cells comprises of GaAs/GaSb tandem stack (multi-junction photovoltaic cell) to employ a more efficient PV cell (col.4; lines 63-65). Hence, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply Stone et al. tandem stack (multi-junction) PV to the modified Streetman to efficiently utilize different energy band gaps of the solar spectrum.

8. Claim 15, 21-23, 25, 26, 30, 31, 32, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman (6,372,979 B1) in view of Stone et al. (5,932,029) and Lechner (5,365,920).

With respect to claim 15, Streetman shows the module (col.3; lines 1-5) comprising of a housing having a cavity of generally optimized closed shape inside said housing, said cavity having an internal surface area A_s and including an opening for admitting radiation into said cavity, said opening having an entrance aperture area A_i that is substantially smaller than A_s (as shown in Figure 1). However, Streetman fails to disclose an apparatus for converting infrared radiation.

Stone describes his invention as apparatus for converting infrared radiation (i.e. coherent laser) radiation from infrared emissions (e.g. laser emitting light) at a

wavelength into electrical power (col.2; lines 3-6) with greater efficiency. Also, he discloses photovoltaic cells tailored to an appropriate band gap energy (band matched: col.3; lines 52-53) to respond to said wavelength and generate said electrical power (col. 1; lines 11-13). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the PV cells tailored in Stone et al. to create a modified Streetman that generates electrical power.

Also, Lechner et al. discloses that his said reflecting concentrator comprises (1) a concentrator for intercepting and concentrating said radiation (e.g. laser radiation), (col.2; lines 25-29) and (2) a secondary concentrator receiving impinging radiation (e.g. laser radiation) from said concentrator (col.2; lines 28-30). He further explains that this received radiation is trapped and directed into a central focal point/line (col.2, lines 33-35). Furthermore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have employ Streetman as modified by Stone that is positioned for receiving said further concentrated radiation (e.g. laser) described in Lechner from said secondary concentrator to operate efficiently.

With respect to claim 21, modified Streetman describes the elements as discussed with regard to claim 15, but fails to show a secondary concentrator system. Lechner et al. further discloses elements of the combination of claim 15, which has a secondary concentrator receiving (impinging) radiation (e.g. laser radiation) from said concentrator (e.g. primary) (col.2; lines 27-30). It would have been obvious to one of ordinary skill in the art at the time of the invention to create a secondary concentrator system for receiving pre-focused radiation from a primary concentrator, where the

modified Streetman is positioned for receiving said further concentrated radiation (e.g. laser).

In regard to claim 22, modified Streetman discloses the elements as discussed with regard to claim 15, but fails to disclose secondary concentrator with inner surfaces mirrored. Lechner discloses the said secondary concentrator including inner surfaces that are mirrored (col.1; lines 39-41) focusing the radiation. Lechner et al. discloses a secondary concentrator mirror for the focusing of the solar radiation (col.1; lines 39-41). The concentrators made of mirror glass provides equal or even better concentration of radiation impinging on the surface of the concentrators' parallel structure (relationship) (col.2; lines 22-24). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to use Lechner secondary concentrator in conjunction with modified Streetman with mirrored inner surfaces for focusing radiation into the module.

With respect to claim 23, modified Streetman discloses the elements as discussed with regard to claim 15, but fails to disclose secondary concentrator as a non-imaging compound parabolic design. Lechner further describes the combination of claim 22 wherein said secondary concentrator is a cylindrical hollow design (col. 2; lines 7-10 and lines 33-36). Nevertheless, Lechner teaches that the secondary concentrator is a compound parabolic of hollow design (col.2; lines 7-10 and lines 33-36) and that it should provide for equal or even a better concentration of radiation hitting the surface of the concentrator. Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to use Lechner secondary concentrator of parabolic hollow design outside of modified Streetman for enhancing the focusing of radiation into the module.

In regard to claim 25, modified Streetman discloses disclose the said secondary concentrator including an integral extractor rod for guiding said light towards the center of said cavity and then to emit photons uniformly in all directions to provide angular isotropy of said photons (as shown in Figure 4).

In regard to claim 26, modified Streetman discloses all of the structured elements as discussed with respect to claim 1 above, but fails to specifically disclose the ratio of A_i to A_s as 0.1. However, similar specifications are shown in Streetman in Figure 1. It has been held that where the only difference between the prior art and the claims was recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device (see MPEP 2144.04 [R-1] IV.).

With respect to claim 30, modified Streetman of claim 15, further discloses wherein said coherent radiation/artificially generating radiation (i.e. suggest laser or incandescent light) suggest the use of an alternative to sunlight radiation in conjunction and artificially generated radiation (col. 1; lines: 40-45) that includes at least two multiplexed wavelengths of radiation (i.e. coming from two sources) (Figure 1), a first wavelength corresponding power component and a second corresponding to communications components (col. 1; lines: 40-45)

However, modified Streetman fails to address the photovoltaic cells having energy band gaps responsive to the communications components and at least some of the photovoltaic cells have an energy bandgap responsive to the communications

component such that the power component and the communications component are demultiplexed.

Stone et al. discloses the method to tailor the spectrum of radiation to photovoltaic cells for high efficiency conversion (col.1; lines 11-13). Wherein, some of the said solar cells each having different energy band gaps has their spectral responses span at least a portion of the solar spectrum (col.5; lines 33-40). Also, Stone et al. shows at least one wavelength filter associated with each solar cell (Figure 3A and 3B), wherein, at least one wavelength filter selected from the group consisting of filters thereby providing selective transmission and reflection of incident solar radiation (col.5; lines 44-47). Hence, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply filters shown in Stone et al. to modified Streetman to efficiently utilize different energy band gaps of the solar spectrum.

In regard to clam 31, Streetman discloses elements of the photovoltaic module of claim 15, but fail to disclose the cells tuned to a frequency corresponding to the electrical component.

Whereas, Stone et al. explicitly states that their photovoltaic (PV) cells comprises of GaAs/GaSb tandem stack (multi-junction photovoltaic cell) to employ a more efficient PV cell (col.4; lines 63-65). Stone further discloses that the wavelength spectrum of the infrared emissions/receiver emitter an electrical component (Figure 1) is tailored to match the optimal incident wavelength spectrum of photovoltaic cells (abstract). Hence, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply Stone et al. tandem stack (multi-junction) PV to the

modified Streetman to efficiently utilize different energy band gaps of the solar spectrum.

In regard to clams 32 and 33, Streetman discloses elements of the photovoltaic module of claim 30, but fail to disclose further comprising: at least one wavelength selective filter associated with each corresponding photovoltaic cell, said filter associated with the cells responsive to the power component for filtering the communications component from the multiplexed wavelengths, and the filter associated with the cells responsive to the communications component for filtering the power component from the multiplexed wavelengths, such that cells responsive to the power component produce an electrical power output and cells responsive to the communications component produce a communications output and also a Rugate filter, for reflecting one of the components of the multiplexed wavelengths, such that only wavelengths are transmitted to each cell for which the cell is responsive for producing a corresponding output.

Stone et al. discloses the method to tailor the spectrum of radiation to

photovoltaic cells for high efficiency conversion (co1.1; lines 11-13). Wherein, some of the said solar cells each having different energy band gaps has their spectral responses span at least a portion of the solar spectrum (col.5; lines 33-40). Also, Stone et al. shows at a wavelength filter (i.e. Rugate filter) associated with each solar cell (Figure 3A and 3B), wherein, at least one wavelength filter selected from the group consisting of filters thereby providing selective transmission and reflection of incident solar radiation

(col.5; lines 44-47). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply the filters shown in Stone et al. to the modified Streetman,to efficiently utilize different energy band gaps of the solar spectrum.

9. Claim 16 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman (6,372,979), Stone et al. (5,932,029), Lechner (5,365,920), as applied to claim 15 above, in view of Knechtli et al. (4,494,302).

In regard to claim 16, modified Streetman discloses elements of the photovoltaic module of claim 15, but fails to describe the reflecting concentrator as comprising of a Cassegrain concentrator. However, Knechtli et al. discloses a Cassegrain mirror concentrator in which the light is focused by the secondary mirror on the solar cell attached to the front of the primary mirror (col. 4; lines 35-39). He also instructs that this is done to project the incoming radiation, which is reflected into the solar cells (col. 4; lines 59-60). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to employ modified Streetman positioned along with the Cassegrain mirror concentrator to further focus the radiation into the photovoltaic module.

With respect to claim 29, modified Streetman fails to disclose the combination of claim 15, including means for transferring waste heat from said photovoltaic module to a back surface of said primary concentrator for radiation into the surrounding environment. Nevertheless, Knechtli discloses the means for transferring waste heat from said photovoltaic module to a back surface of said primary concentrator for radiation into the surrounding environment (col.4; lines 39-40). He describes making the

back of the primary concentrator black to serve as a radiator dissipating the heat from the solar cell. Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to use Knechtli et al. means for transferring waste heat to reduce radiation induced damage of the modified Streetman.

10. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman (6,372,979), Stone et al. (5,932,029), Lechner (5,365,920) as applied to claim 15 above, in view of Knechtli (4,494,302) and Osborn et al. (4,335,578).

In regard to claim 17, modified Streetman discloses elements of the photovoltaic module of claim 15, but fails to describe a Cassegranian concentrator. Knechtli describes the primary concentrator as a parabolic concentrator and the secondary concentrator as a hyperbolic concentrator (col.4; lines 35-39). Furthermore, Osborn et al. discloses the parabolic dish concentrator in Figure 1 and teaches that the setup is given to focus the radiation (col.2; lines47-49). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to employ modified Streetman in a combination of Knechtli Cassegrain concentrator with Osborn's parabolic and hyperbolic design in order to focus the incoming radiation.

11. Claim 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman (6,372,979), Stone et al. (5,932,029), and Lechner (5,365,920) as applied to claim 15 above, in view of Chappell (4,525,731) and Wanlass (5,376,185).

In regard to claim 18, modified Streetman discloses elements of the photovoltaic module of claim 15, but fails to disclose the said photovoltaic cell is a single junction cell having a receiving surface on which said laser radiation is incident. However, Wanlass discloses the use of a single junction for his concentrator solar cell (col. 1, lines 36-41). Also, Wanlass teaches that a concentrator solar cell operates at higher light generated current density, and the single junction cell is also less costly (col.2; lines 19-22). Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to use Wanlass single junction cell in the photovoltaic module of modified Streetman to respond to the said wavelength in order to generate electrical power in a less costly manner.

Furthermore, Chappell discloses a photovoltaic cell with a receiving surface on which said light is incident (col. 2; lines 51-54) as the best mode for carrying out his invention. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to employ the Streetman as modified by Wanlass utilizing single junction cells with a receiving surface as the best mode in operating the PV module.

With respect to claim 19, modified Streetman discloses the elements as discussed with regard to the combination of claim 18, wherein each photovoltaic cell is provided with a back surface mirror/ reflective material (col.3; lines 50-54) for reflecting photons not absorbed by a photovoltaic cell on which said photons are incident.

In regard to claim 20, Wanlass discloses the elements as discussed with regard to the combinations of claim 18, and he describes the method of calculating the

quantum efficiency of PV cells to determine it as a function of the optimum band gap or wavelength (col.3; lines 19-27).

12. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman (6,372,979), Stone et al. (5,932,029), Lechner (5,365,920) as applied to claim 15 above, in view of Kuppenheimer et al. (4,710,630).

With respect to claim 24, Streetman, as modified by Lechner, discloses the combination of claim 22, but fails to discuss the secondary concentrator as a Bezier optimized contour to provide a combination of maximum acceptance angle, maximum concentration, and minimum height.

Kuppenheimer has disclosed the secondary concentrator as a compound parabolic concentrator (a Bezier optimized contour) (col.2; lines 45-46). He describes the maximum acceptance angle as the point where the curvature of the angle converting cone goes from a compound parabolic concentrator to a straight wall cone as the point where the marginal off axis ray (the ray from the lens which comes from the edge of the field of view and passes through the edge of the lens) strikes the collector wall, and is reflected to the edge, where this is the maximum acceptable impingement angle (col.2; lines 45-53). Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to use Kuppenheimer et al. secondary concentrator of a parabolic design outside of the modified Streetman for enhancing the focusing of radiation into the module.

13. Claim 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Streetman (6,372,979), Stone et al. (5,932,029), Lechner (5,365,920) as applied to claim 15 above, in view of Wanlass (5,376,185).

With respect to claim 27, modified Streetman discloses the elements as discussed with regard to claim 15, but fails to address the optimized wavelength (band gap) of the photovoltaic (PV) cells. Whereas, Wanlass teaches that his computer model can determine the solar cell efficiency as a function of the band gap of the cell (col. 3; lines 54-53). Also, he discloses a computer model for single junction photovoltaic (solar) cells that calculates an optimum band gap for a given radiating conditions (col.3; lines19-32). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to apply Wanlass models for choosing PV cells with an optimized band gap energy to be applied to the modified Streetman to operate at the optimum wavelength in order to achieve maximized efficiency.

With respect to claim 28, modified Streetman discloses the elements as discussed with regard to claim 15, but fails to disclose the said photovoltaic cells (PV) have given quantum efficiency selected to optimize the conversion of said wavelength of said radiant energy. Wanlass describes a computerized calculation of solar cell efficiency determined as a function of the optimum band gap (col.3; lines 19-27). Furthermore, his computerized model can determine the solar cell peak (optimum) efficiency of the cell as a function of the band gap energy of the incoming radiation onto the PV cells (col. 3; lines 54-53). Hence, it would have been obvious to one of ordinary

skill in the art at the time of invention to use Wanlass model to find the optimized quantum efficiency of modified Streetman at given wavelength.

Response to Arguments

35 U.S.C. 112 2nd paragraph Rejection

1. The Applicant has not corrected the lack of antecedent basis for claim 17 as mentioned in the first office action on the merits, thereby the 35 U.S.C. 112 2nd paragraph is maintained.

35 U.S.C. 103 (a) Rejection

2. The Applicant argues that Streetman does not contemplate or use or suggest the use of a laser to produce the light, nor does Streetman suggest that the incandescent light from the burning of natural gas is directed into the device from the exterior.

The Examiner respectfully disagrees. Streetman discloses the use of artificially generating radiant energy as distinguished from natural radiation from sunlight (col. 3; lines: 17-20). The Examiner has interpreted artificially generating radiant energy as suggesting the use of a laser.

The Applicant argues that the aperture in Streetman is not substantially different than the area inside the [Streetman's] hemisphere.

The Examiner respectfully disagrees. Streetman discloses the spherical cavity of generally optimized closed shape (Figure 1) having an internal surface area and including opening for admitting said laser radiation into said cavity, said opening having an entrance aperture area (17 and 18) that is substantially smaller than the internal

surface area (as shown in Figure 1) and a plurality of photovoltaic cells (col.3; lines 17-20) within said cavity.

The Applicant argues that Streetman fails to explain why he uses a spherical cavity and not for example a cylinder or a square box. He also does not suggest that it is possible or desirable to perform the photon recycling process of the invention that significantly increases the conversion efficiency of the cavity.

The Examiner respectfully disagrees. Streetman discloses that the housing (32) has a spherical inner surface and has a shape to provide magnification (photon recycling) of radiation thereby intensifying (i.e. increasing) the radiation (col. 4; lines: 1-5 & 9-16).

The Applicant further argues that Streetman does not mention the unique properties of a near diffraction limited, coherent laser beam as compared to solar or any other artificially generated radiant energy.

The Examiner respectfully disagrees. Streetman discloses the use of artificially generating radiant energy as distinguished from natural radiation from sunlight (col. 3; lines: 17-20). The Examiner has interpreted artificially generating radiant energy as suggesting the use of a laser.

The Applicant argues that Wanlass does not consider or suggest the extension of TVP cells to laser applications. Thus, the Examiner's suggestion is believed to be based on conjecture and is unsupported by the cited art.

The Examiner respectfully disagrees. Wanlass solves the deficiencies of Streetman as presented above.

Conclusion

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to ASHA HALL whose telephone number is (571)272-9812. The examiner can normally be reached on Monday-Thursday 8:30-7:00PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on 571-272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

AJH
/A. H./
Examiner, Art Unit 1795

/Alexa D. Neckel/
Supervisory Patent Examiner, Art Unit 1795